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10/645,646

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EXAMINER

PHAM, THANHHA S

ART UNIT

PAPER NUMBER

2813

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07/13/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

**Office Action Summary**

Application No.

10/645,646

Applicant(s)

COHEN, GUY MOSHE

Examiner

Thanhha Pham

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 27 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-12, 21-24 and 28-43 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-12, 21-24, 28-43 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date. _____   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

This Office Action is in response to Applicant's Amendment dated 4/27/2007.

### ***Claim Objections***

- 1. Claims 1-12, 21, 23-24, 28-43 are objected to because of informalities.**

**Appropriate correction are required to clarify scopes of claims.**

- ▶ With respect to claims 1, 21, 30 and 31,  
"said channel" lacking antecedent basis should be changed to said strained-silicon channel to clarify scope of claim.
- ▶ With respect to claims 2-12, 23-24, 28-29, 32-36,  
line 1, "The transistor" should changed to – The double-gate field effect transistor--for clarifying the scope of the claim.
- ▶ With respect to claims 30 and 31,  
"said channel" lacking antecedent basis should be changed to said strained-silicon channel to clarify scope of claim.
- ▶ With respect to claim 37,  
line 1, "The transistor" should changed to – The double-gate field effect transistor --  
lines 1-2, "said channel" should be changed to – said strained-silicon channel –
- ▶ With respect to claim 38,

line 1, "The transistor" should be changed to – The double-gate field effect transistor --

lines 1-2, "said channel" should be changed to – said strained-silicon channel –

► With respect to claims 39-43,

"The transistor" should be changed to – The double-gate field effect transistor-

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**1. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

► With respect to claim 12,

it is not clear how a planarized top surface of device is defined. It is not clear that a planarized top surface is actually a planarized top surface of which element.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**2. Claims 1-12, 21-24, and 28-35 are rejected under 35 U.S.C. 102(e) as being anticipated by Joshi (US006921982B2) previously applied.**

► With respect to claim 1, Joshi (fig. 8F, col. 10) discloses a double-gate field effect transistor (87) (see column 10 line 4) comprising:

a strained-silicon channel (16) formed adjacent a source (12) and drain (14) (see column 10 lines 9-10);

first gate (88) formed over a first side of said strained-silicon channel (16);

a second gate (89) formed over a second side of said strained silicon channel (16);

a first gate dielectric (33) formed between said first gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric); and

a second gate dielectric (33) formed between said second gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric),

wherein said strained-silicon channel (16) is non-planar (figure 8F).

► With respect to claim 2, Joshi (fig. 8F) discloses that the strained-silicon channel (16) thickness is substantially uniform (figure 8F).

► With respect to claim 3, Joshi (fig. 8F, col. 10) discloses that the strained-silicon channel (16) thickness is set by epitaxial growth (column 8 lines 1-4).

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► With respect to claim 4, Joshi discloses that the strained-silicon channel (16) is substantially defect-free (column 7 lines 18-20, high quality SiGe free from dislocations).

It is noted that the strained-silicon channel (16) substantially defect-free considers as strained-silicon channel (SiGe) free from dislocations since the claimed "defect-free" is not defined the structure of the strained-silicon channel.

► With respect to claim 5, Joshi (fig. 8F, col. 10) discloses that the strained-silicon channel (16) includes a distorted lattice cell. This is inherent to a strained layer.

► With respect to claim 6, Joshi (fig. 8F, col. 10 line 11-14) discloses that the first gate (88) and the second gate (89) are independently controllable.

► With respect to claim 7, Joshi (fig. 8F, col. 10 line 4) discloses that the strained silicon channel (16) comprises a fin.

► With respect to claim 8, Joshi (fig. 8F) discloses that the first and second gates are self-aligned.

► With respect to claim 9, the limitation of forming the first and second gates in a single lithography step is a process limitation (product by process) and has no patentable weight in device claims. Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production."

MPEP 2113

► With respect to claim 10, Joshi (fig. 8F) discloses that the first gate and second gate, the source and the drain are self-aligned with respect to each other.

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► With respect to claim 11, the background of the invention teaches that it is known to use one or more fins (column 1 line 42-44). Also see column 7 lines 64-65 and column 8 lines 42-43).

► With respect to claim 12, Joshi (fig. 8F) discloses that the double-gate field effect transistor includes a planarized top surface.

► With respect to claim 28, Joshi (fig. 8F) discloses that the first gate (88) is separated from the second gate (89).

► With respect to claim 32, the claim is a product by process claim and the process is given no patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production."

MPEP 2113

► With respect to claim 34, Joshi (fig. 8F, column 10 line) discloses that the strained-silicon channel is controlled by said first gate (88) and by the second gate (89). Furthermore, "When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent" MPEP 2112.01 1. As the structure of claim 1 is that taught by Joshi, it is inherent the same function is inherent.

► With respect to claim 36, Joshi (fig. 8F) discloses that the first gate (88) and the second gate (89) are separated from one another.

► With respect to claim 37, Joshi (fig. 8F, column 10) discloses that carriers in the channel are inherently controlled by the first gate and the second gate. Furthermore,

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"When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent" MPEP 2112.01 1.

As the structure of claim 1 is that taught by Joshi, it is inherent the same function is inherent.

► With respect to claim 38, Joshi (fig. 8F) discloses that the channel (16) a first vertical surface covered by the first gate dielectric (33) and a second vertical surface covered the second gate dielectric (33).

► With respect to claim 21, Joshi (fig. 8F, col. 10) discloses a double-gate field effect transistor (87) (see column 10 line 4) comprising:

a strained-silicon channel (16) formed adjacent a source (12) and drain (14) (see column 10 lines 9-10);

first gate (88) formed over a first side of said strained-silicon channel (16);

a second gate (89) formed over a second side of said strained-silicon channel (16);

a first gate dielectric (33) formed between said first gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric); and

a second gate dielectric (33) formed between said second gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric),

wherein said strained-silicon channel (16) comprises a fin (column 10 line 4).

► With respect to claim 22, Joshi (fig. 8F, col. 10) discloses that a circuit may comprise the double-gate field effect transistor of claim 1 (column 1 lines 14-45).



- ▶ With respect to claim 23, Joshi (fig. 8F, column 5 lines 40-45) discloses that the strained silicon channel (16) is tensely strained.
- ▶ With respect to claim 24, Joshi (fig. 8F, column 5 lines 40-45) discloses that the strained silicon channel (16) is compressively strained.
- ▶ With respect to claim 29, Joshi (fig. 8F) discloses that the first gate (88) is separated from the second gate (89).
- ▶ With respect to claim 33, the claim is a product by process claim and the process is given no patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production."

MPEP 2113

- ▶ With respect to claim 35, Joshi (fig. 8F, column 10 line) discloses that the strained-silicon channel is controlled by said first gate (88) and by the second gate (89). Furthermore, "When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent" MPEP 2112.01 1. As the structure of claim 1 is that taught by Joshi, it is inherent the same function is inherent.

- ▶ With respect to claim 30, Joshi (fig. 8F, col. 10) discloses a double-gate field effect transistor (87) (see column 10 line 4) comprising:

a strained-silicon channel (16) formed adjacent a source (12) and drain (14) (see column 10 lines 9-10);

first gate (88) formed over a first side of said strained-silicon channel (16);

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a second gate (89) formed over a second side of said strained-silicon channel (16);

a first gate dielectric (33) formed between said first gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric); and

a second gate dielectric (33) formed between said second gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric),

wherein said strained-silicon channel (16) is non-planar, and the first and second sidewalls are opposing to each other (figure 8F).

► With respect to claim 31, Joshi (fig. 8F, col. 10) discloses a double-gate field effect transistor (87) (see column 10 line 4) comprising:

a strained-silicon channel (16) formed adjacent a source (12) and drain (14) (see column 10 lines 9-10);

first gate (88) formed over a first side of said strained-silicon channel (16);

a second gate (89) formed over a second side of said strained-silicon channel (16);

a first gate dielectric (33) formed between said first gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric); and

a second gate dielectric (33) formed between said second gate and said strained-silicon channel (16) (see column 6 lines 13-18, gate on dielectric),

wherein said strained-silicon channel (16) is non-planar, and is fixed to a substrate (20) by the first and second gates.

It is noted that the claim limitation "elastically induced by a sacrificial stressor" is a product by process claim and the process is given no patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production." MPEP 2113

**2. Claims 1-12, 21-22, 30-31, 34-43 are rejected under 35 U.S.C. 102(e) as anticipated by Clark et al [US 2003/0178677]**

► With respect to claims 1-2, 4-7, 12, 21-22, 38-41, Clark et al (figs 23 & 24, text [0001]-[0047]) discloses the claimed double-gate field effect transistor comprising:

a strained-silicon channel (11/130) formed adjacent a source and drain (source and drain defined in fin body 155), said strained-silicon channel thickness is substantially uniform and substantially defect-free, said strained-silicon channel includes a distorted lattice cell (text 0030)-[0031]);

first gate (50) formed over a first side of said strained-silicon channel;

a second gate (160) formed over a second side of said strained-silicon channel;

a first gate dielectric (140) formed between said first gate and said strained-silicon channel; and

a second gate dielectric (150) formed between said second gate and said strained-silicon channel;

wherein said strained-silicon channel is non planar (having facet/corner portion) and has a fin;

wherein said first gate (50) has a planarized top surface;

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wherein said strained-silicon channel (11/130) comprises a first vertical surface covered by said first gate dielectric (40) and a second vertical surface covered by said second gate dielectric (150), said first gate dielectric (oxide layer being formed by oxidizing Si) is chemically different than said second gate dielectric (oxide layer being formed by oxidizing SiGe), wherein a thickness of said first gate dielectric is independent of a thickness of said second gate dielectric;

wherein said first gate (n+ doped gate) comprises at least one chemical element not included in said second gate (p+ doped gate) [text [0034]];

► With respect to claims 3, 9, 32-33, the process limitation of "epitaxial growth", "defined by a single lithographic step" and "elastically induced by a sacrificial stressor" is a product by process claim and the process is given no patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production." MPEP 2113

► With respect to claim 42, Clark et al shows a fix material (12) disposed under said second gate.

► With respect to claim 43, Clark et al shows a oxide plug (100) formed over said fin.

► With respect to claims 30-31, Clark et al (figs 23 & 24, text [0001]-[0047]) discloses the claimed semiconductor device comprising:

a strained-silicon channel (11/130) formed adjacent a source and drain (source and drain defined in fin body 155);

first gate (50) formed over a first side/sidewall of said strained-silicon channel;  
a second gate (160) formed over a second side/sidewall of said strained-silicon channel;

a first gate dielectric (140) formed between said first gate and said strained-silicon channel; and

a second gate dielectric (150) formed between said second gate and said strained-silicon channel;

wherein said strained-silicon channel is non planar (having facet/corner portion), said first and second side/sidewalls are opposing to each other;

It is noted that the claim limitation "elastically induced by a sacrificial stressor" is a product by process claim and the process is given no patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of Patentability is based upon the product itself. The patentability of a product does not depend on its method of production." MPEP 2113

### ***Response to Arguments***

**3. Applicant's arguments filed 10/11/2006 have been fully considered but they are not persuasive.**

Applicant argues that Joshi does not teach or suggest "a double-gate field effect transistor", as recited in claim 1, and similarly recited in claims 21, 30 and 31.

Applicant's argument is not persuasive because Joshi clearly disclose a double-gate field effect transistor (87) having the first gate (88) and the second gate (89) (see

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fig. 8F, column 10 lines 4-5). Therefore, Joshi meets and anticipates the claimed invention.

Applicant argues that *"the channel 8 (Si Fin) has two vertical surfaces. Each of these surfaces is covered with a gate oxide and is gated by gate 1 and gate 2, respectively. The carriers in the channel are therefore controlled effectively by gate 1 and gate 2. This is not the case for the carriers in channel 32 of Joshi, where the two gates are distanced by the core 24. Even if core 24 were made ultra thin, there is no gate oxide that coats the inner surface of channel 32. As a result, only one surface of the channel 32 is gated as the other (inner) surface is in contact with the core 24 and is not gated"*.

Applicant's argument is not persuasive because there is no basis for this statement *"the channel 8 (Si Fin) has two vertical surfaces. Each of these surfaces is covered with a gate oxide and is gated by gate 1 and gate 2, respectively"*. Moreover, Joshi (fig. 8F) clearly discloses the channel (16) has two vertical surfaces. Each of these surfaces is covered with a gate oxide (33) and is gated by gate (88) and gate (89), respectively. It is noted that, the core (24) is part of the channel (16)(see column 5 lines 10-33).

### ***Allowable Subject Matter***

3. The following claim 1 drafted by the examiner and considered to distinguish patentably over the art of record in this application, is presented to applicant for consideration:

A double-gate field effect transistor comprising:

a strained-silicon channel formed adjacent a source and drain on a substrate, said strained-silicon channel comprising two separated portions wherein each of said two separated portions of said strained-silicon channel connects said source and said drain;

first gate formed over a first vertical outer side of said strained-silicon channel;

a second gate formed over a second vertical inner side of said strained-silicon channel located between said two separated portions of said strained-silicon channel;

a first gate dielectric formed between said first gate and said strained-silicon channel; and

a second gate dielectric formed between said second gate and said strained-silicon channel;

wherein said strained-silicon channel is non planar, said first gate comprises at least one chemical element not included in said second gate, said first dielectric is chemically differently than said second dielectric gate.

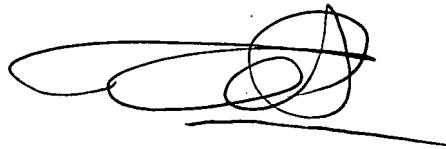
### ***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TSP

A handwritten signature in black ink, consisting of several overlapping loops and a long horizontal stroke at the bottom.

THANHHA S. PHAM  
PRIMARY EXAMINER